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Indian Gooseberry (*Emblica officinalis*): Pharmacognosy Review

Madhulika Bhagat^{1*}

ABSTRACT

Wonder berry, *Emblica officinalis* Gaertn., commonly known as Indian gooseberry or amla, is used in Ayurveda as a potent Rasaayana. The traditional system of medicine used almost all of its parts i.e. roots, leaves, stems but mostly it is known for astonishing properties of fruits. The fruit is used either alone or in combination with other plants to treat many ailments such as common cold and fever, as a diuretic, laxative, liver tonic, refrigerant, stomachic, restorative, alterative, antipyretic, anti-inflammatory, hair tonic, to prevent peptic ulcer and dyspepsia, and as a digestive. The present review gives an account of updated information on its phytochemical and pharmacological properties. The fruit is rich in quercetin, phyllaemblic compounds, gallic acid, tannins, flavonoids, pectin and vitamin C and also contains various polyphenolic compounds. A wide range of phytochemical components including terpenoids, alkaloids, flavonoids and tannins have been shown to possess useful biological activities. In addition, experimental studies have shown that some of its phytochemicals such as gallic acid, ellagic acid, pyrogallol, some non-sesquiterpenoids, corilagin, geraniin, elaeocarpusin, and prodelphinidins B1 and B2 also possess anti-neoplastic effects. Preclinical studies have shown that amla possesses anti-pyretic, analgesic, cardioprotective, gastroprotective, anti-hypercholesterolemia, wound healing, hepatoprotective, chemopreventive, free radical scavenging, antioxidant, anti-inflammatory, anti-mutagenic and immunomodulatory properties. In view of its reported pharmacological properties and relative safety, it can be said that *E. officinalis* is a source of potential therapeutically useful products.

Keywords: *Emblica officinalis*, Triphala, Phytochemical constitutes, Pharmacological uses.

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Introduction

Medicinal plants have been used for thousands of years in herbal preparations of the Indian traditional health care system (Ayurveda) named Rasayana. *Emblica officinalis* (Amla) has an important position in Ayurveda- an Indian indigenous system of medicine. According to belief in ancient Indian mythology, it is the first tree to be created in the universe. It is a deciduous tree which belongs to family Euphorbiaceae. It is also commonly known as Amla in Hindi, *Phyllanthus emblica* or Indian gooseberry. The species is native to India and also grows in tropical and sub-tropical regions. The fruits of Indian gooseberry are pale yellowish, fleshy, globose (Figure 26.1) and are widely used in the Aryurveda and are believed to increase defense against diseases.

Classification

| | |
|-----------------|------------------------------|
| <i>Kingdom</i> | : Plantae |
| <i>Division</i> | : Angiospermae |
| <i>Class</i> | : Dicotyledonae |
| <i>Order</i> | : Geraniales |
| <i>Family</i> | : Euphorbiaceae |
| <i>Genus</i> | : <i>Emblica</i> |
| <i>Species</i> | : <i>officinalis</i> Geartn. |



Figure 26.1: *Emblica officinalis* (Amla).

Botanical Description

A small to medium sized deciduous tree, 8-18 meters height with thin light grey bark exfoliating in small thin irregular flakes, leaves are simple, sub-sessile, closely set along the branchlets, light green having the appearance of pinnate leaves; flowers are greenish yellow, in axillary fascicles, unisexual, males numerous on short slender pedicels, females few, subsessile, ovary 3-celled; fruits globose, fleshy, pale yellow with six obscure vertical furrows enclosing six trigonous seeds in 2-seeded 3 crustaceous cocci (Nemmani *et al.*, 2002).

Geographical Distribution

It is commonly found in tropical, sub-tropical, the sea-coast districts and on hill slopes upto 200 meters, also cultivated in plains and in heights of Kashmir and also found in Burma, it is abundant in deciduous forests of Madhya Pradesh (Chaudhuri, 2004; Sai *et al.*, 2002; Bhattacharya *et al.*, 1999).

Planting

Amla is generally propagated through seeds, but seed propagated trees bear inferior quality fruits and have a long gestation period. Shield budding is done on one year old seedlings with buds collected from superior strains yielding big size fruits. Older trees of inferior types can be rejuvenated and easily changed into superior type by top working. The pits of 1m³ are prepared during May-June at a distance of 4.5 m spacing and should be left for 15-20 days exposed to sunlight. Each pit should be filled with surface soil mixed with 15 kg farm yard manure and one kg of super phosphate before planting the grafted seedling.

Description

Tree; leaves alternate, bifarious, pinnate, flower -bearing; leaflets numerous, alternate, linear-obtuse, entire; petioles striated, round; calyx 6-parted; flowers in the male very numerous in the axils of the lower leaflets, and round the common petiole below the leaflets; in the female few, solitary, sessile, mixed with some males in the most exterior floriferous axils; stigmas 3; drupe globular, fleshy, smooth, 6-striated; nut obvate-triangular, 3-celled; seeds 2 in each cell; flowers small, greenish yellow. Flower during October (Treadway, 1994).

Photochemical constituents

Amla contains calcium, phosphorous, iron, carotene, thiamine, riboflavin, and niacin. The seeds of Indian gooseberry contain fixed oil, phosphatides and essential oil. The fruits, leaves and bark are rich in tannins. The roots contain ellagic acid and lupeol and bark contains leucodelphinidin. The seeds yield a fixed oil (16 per cent) which is brownish-yellow in colour. It has the following fatty acids: linolenic (8.8 per cent), linoleic (44.0 per cent), oleic (28.4 per cent), stearic (2.15 per cent), palmitic (3.0 per cent) and myristic (1.0 per cent). Ethanol soluble fraction contains free sugars, D-glucose, D-fructose, D-myo-inositol. The acidic water soluble fraction contains pectin with D-galacturonic acid, D-arabinosyl, D-rhamnosyl, D-xylosyl, D-glucosyl, D-mannosyl and D-galactosyl residues (Bhattacharya *et al.*, 1999). The low molecular weight hydrolyzable tannins (<1,000), namely Emblica nin A and Emblica nin B,

along with pedunculagin and punigluconin are the key ingredients in *Emblica* (Kim *et al.*, 2005). It contains 3-6-di-o-galloyl-glucose (Fruit), 3-6-di-o-galloyl-glucose (Shoot), Alanine (Fruit), Amlaic-acid (Leaf), Arginine (Fruit), Ascorbic-acid (Fruit), Ascorbic-acid (Plant), Ash (Fruit), Aspartic-acid (Fruit), Astragalin (Leaf), β -carotene (Fruit), β -sitosterol (Bark, Seed Oil, Tissue Culture, Shoot), Boron (Fruit), Calcium (Fruit), Carbohydrates (Fruit), Chebulagic acid (Fruit), Chebulagic acid (Shoot), Chebulaginic acid (Fruit), Chebulic acid (Fruit), Chibulinic acid (Fruit), Chibulinic acid (Shoot), Chloride (Fruit), Copper (Fruit), Corilagic acid (Fruit), Corilagin (Fruit, Shoot), Cystine (Fruit), D-fructose (Fruit), D-glucose (Fruit), Ellagic acid (Fruit, Shoot, Root, Pericarp and Leaf), Emblicol (Fruit, Pericarp), Ethyl gallate (Fruit), Fat (Fruit and Seed), Fibre (Fruit), Gallic acid (Fruit, Shoot, Pericarp), Gallic acid ethyl ester (Fruit, Tissue Culture), Gallo-tannin (Leaf), Gibberellin-a-1 (Fruit), Gibberellin-a-3 (Fruit), Gibberellin-a-4 (Fruit), Gibberellin-a-7 (Fruit), Gibberellin-a-9 (Fruit), Glucogallin (Fruit), Glucogallin (Shoot), Glucose (Fruit), Glutamic acid (Fruit), Glycine (Fruit), Histidine (Fruit), Iron (Fruit), Isoleucine (Fruit), Kaempferol (Leaf), Kaempferol-3-o-glucoside (Leaf), Leucine (Fruit), Leucodelphinidin (Bark), Linoleic acid (Seed, Seed Oil, Linolenic acid (Seed, Seed Oil), Lupenone (Plant), Lupeol (Bark, Root, Shoot), Lysine (Fruit), Magnesium (Fruit), Manganese (Fruit), Methionine (Fruit), Myo-inositol (Fruit), Myristic acid (Fruit, Seed Oil), Niacin (Fruit), Nitrogen (Fruit), Oleic acid (Seed, Seed Oil), Palmitic acid (Seed, Seed Oil), Pectin (Fruit), Phenylalanine (Fruit), Phosphorus (Fruit), Phyllantidine (Fruit, Tissue Culture, Leaf), Phyllantine (Fruit, Leaf, Tissue Culture), Phyllemblic acid (Fruit, Pericarp), Phyllemblic acid (Fruit), Phyllemblic acid (Fruit), Polysaccharide (Fruit), Potassium (Fruit), Proline (Fruit), Protein (Fruit), Quercetin (Tissue Culture), Riboflavin (Fruit), Rutin (Fruit, Leaf), Selenium (Fruit), Serine (Fruit), Silica (Fruit), Sodium (Fruit), Starch (Fruit), Stearic acid (Seed, Seed Oil), Sucrose (Fruit), Sulfur (Fruit), Tannin (Bark, Fruit, Twig, Leaf), Terchebin (Fruit), Thiamin (Fruit), Threonine (Fruit), Trigalloyl glucose (Fruit), Tryptophan (Fruit), Tyrosine (Fruit), Valine (Fruit), Water (Fruit), Zeatin (Fruit), Zeatin nucleotide (Fruit), Zeatin riboside (Fruit), Zinc (Fruit) (Srikumar *et al.*, 2007).

Active Principle

Tannins, Gallic acid and Pyrogallol (Veena *et al.*, 2006)

Ethno-botanical Uses

In traditional Indian medicine, dried and fresh fruits of the plant are used. All parts of the plant are used in various Ayurvedic/Unani medicine (*Jawarish amla*) herbal preparations, including the fruit, seed, leaves, root, bark and flowers. According to Ayurveda, amla fruit is sour and astringent in taste, with sweet, bitter and pungent secondary tastes. Its qualities are light and dry, the post-digestive effect is sweet, and its energy is cooling. It may be used as rejuvenative to promote longevity, and traditionally to enhance digestion, treat constipation, reduce fever, purify the blood, reduce cough, alleviate asthma, strengthen the heart, benefit the eyes, stimulate hair growth, enliven the body, and enhance intellect. They are useful in vitiated conditions of tridosha, diabetes, dyspepsia, colic, flatulence, hyperacidity, peptic ulcer, erysipelas, skin diseases, leprosy, haematogenesis, inflammations, anemia, emaciation, hepatopathy, jaundice, strangury, diarrhoea, dysentery, hemorrhages, leucorrhoea,

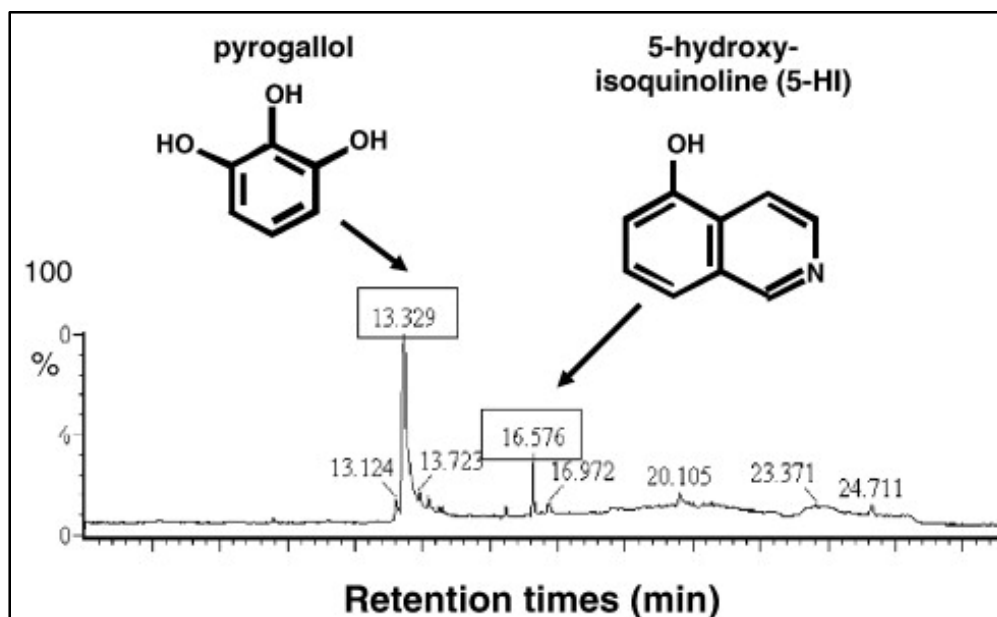


Figure 26.2: Gas chromatography/mass spectrometry analysis of the n-butanol fraction of *Emblica officinalis* extracts.

menorrhagia, cardiac disorders, intermittent fevers and greyness of hair (Thakur, 1989; Saeed and Tariq, 2007; Jayaweera, 1980; Chaudhuri *et al.*, 2003; Tasduq *et al.*, 2005; Biswas *et al.*, 2001).

In Ayurvedic polyherbal formulations, Indian gooseberry is a common constituent, and most notably is the primary ingredient in an ancient herbal *rasayana* called *Chyawanprash*. http://en.wikipedia.org/wiki/Indian_gooseberry-cite_note-dharm-12 This formula, which contains 43 herbal ingredients as well as clarified butter, sesame oil, sugar cane juice, and honey, was first mentioned in the Charaka Samhita as a premier rejuvenative compound. Another very important and popularly used Ayurvedic herbal *rasayana* churna is Triphala churna consisting of equal parts of three myrobalans, taken without seed: Amalaki (*Phyllanthus emblica*), Bibhitaki (*Terminalia bellirica*), and Haritaki (*Terminalia chebula*). Triphala is a mild laxative, which cleanses and tonifies the gastro-intestinal tract, including a blood cleanser. The herb also has a high nutritional value, including high levels of vitamin C (McIntyre, 2005; Jagetia, 2004).

Pharmacology and Clinical Studies

Antioxidant and Anti-ageing Effect

The use of amla as an antioxidant has been examined by a number of researchers (Vani, 1997; Bhattacharya *et al.*, 1999; Golechha *et al.*, 2012). The studies showed that Amla preparations contained high levels of the free-radical scavenger, superoxide dismutase (SOD), in the experimental subjects (Treadway, 1994). *Emblica officinalis* (Eo) reduced UV-induced erythema and showed free-radical quenching ability, chelating ability to iron and copper as well as MMP-1 and MMP-3 inhibitory activity (Chaudhuri, 2003). In another study, amla was studied against the cold stress-induced

alterations in the behavioural and biochemical abnormalities. Triphala was administered orally about 1g/kg/animal body weight for 48 days. It significantly prevented cold stress-induced behavioral and biochemical abnormalities in albino rats (Dhanalakshmi *et al.*, 2007). The hydrolysable tannins emblicanin A (2,3-di-*o*-galloyl-4,6-(*S*)-hexahydroxydiphenoyl-2-keto-glucono-d-lactone) and emblicanin B (2,3,4,6-bis-(*S*)-exahydroxydiphenoyl-2-keto-glucono-d-lactone) proved as very strong antioxidant. These two emblicanins A and B also preserve erythrocytes against oxidative stress induced by asbestos, generator of superoxide radical. Emblicanin A oxidates when put in contact with asbestos becoming emblicanin B and together they have a stronger protective action to erythrocytes than vitamin C. Moreover they improve the efficacy of vitamin C in reducing dihydroascorbic acid to ascorbic acid. The same recycling process has been observed in the rutin-vitamin C combination (Scartezzini and Speroni, 2002).

Immunomodulation Effect

Emblica officinalis had shown to modulate the immune system and the inflammatory response. Immunomodulatory activity of Triphala (an herbal formulation containing fruits of *Emblica officinalis*, *Terminalia chebula* and *Terminalia bellerica* in equal proportions) was reported by Srikumar and his co-worker in albino rats. They showed that Triphala stimulates the neutrophil functions in the immunized rats and stress induced suppression in the neutrophil functions (Srikumar *et al.*, 2005). Another ayurvedic polyherbal formulation Immu-21, containing extracts of an *Emblica officinalis*, *Ocimum sanctum*, *Withania somnifera* and *Tinospora cordifolia* showed immunomodulatory response in mice. Pretreatment with Immu-21 selectively elevated the proliferation of splenic leukocyte to B cell mitogen, LPS and cytotoxic activity against K 562 cells in mice (Nemmani *et al.*, 2002). The immunosuppressive effects of Cr on lymphocyte proliferation and restoration of the IL-2 and gamma-IFN production was reported (Sai *et al.*, 2002).

Antipyretic, Analgesic and Anti-inflammatory effect

Extracts of *Emblica officinalis* leaves and fruits possess potent anti-pyretic, analgesic as well as anti-inflammatory activity (Mythilypriya *et al.*, 2007; Gupta *et al.*, 2013; Asmawi *et al.*, 1993; Ihantola-Vormisto *et al.*, 1997; Muthuraman *et al.*, 2011). A single oral dose of ethanolic extract and aqueous extract (500 mg/kg, i.p.) showed significant reduction in hyperthermia in rats induced by brewer's yeast. Both of these extracts elicited pronounced inhibitory effect on acetic acid-induced writhing response in mice in the analgesic test (Perianyagam *et al.*, 2004). Yet in other studies, fruit extract was found to be an effective anticoagulant and anti-inflammatory agent as it potentially and significantly reduced lipopolysaccharide (LPS)-induced tissue factor expression and von Willebrand factor release in human umbilical vein endothelial cells (HUVEC), it also decreased the concentrations of pro-inflammatory cytokines, TNF- α and IL-6 in serum on oral administration of the amla fruit extract (50 mg/kg body weight (Pradyumna *et al.*, 2013). Further, the Beta-glucogallin an aldose reductase inhibitor that catalyzes the reduction of toxic lipid aldehydes to their alcohol products and mediates inflammatory signals triggered by

lipopolysaccharide (LPS) was isolated from *Emblica officinalis*. This molecule may be a potential therapy for inflammatory diseases (Chang *et al.*, 2013).

Chemoprotective and Anticancer Effect

Emblica officinalis is a wonder berry known for the treatment and prevention of cancer (Rajarama and Siddiqui, 1964; Jeena *et al.*, 2001; Wiart, 2013). The crude extract of *Emblica officinalis* was reported to counteract hepatotoxic and renotoxic effects of metals due to anti-oxidant activity (Roy *et al.*, 1991). Triphala exhibits chemopreventive potential when included in the diet of the mice, results in the lowering of the benzo(a)pyrene [B(a)P] induced forestomach papillomagenesis this may be due to the increased antioxidant status in animals by Triphala (Deep *et al.*, 2005). Lipid-metabolizing enzymes, lipids and lipoproteins are reported to be associated with the risk of breast cancer. Kalpaamruthaa (KA) is a modified Siddha preparation containing *Emblica officinalis*, *Semecarpus anacardium* (SA) and honey. The elevated levels of free cholesterol, total cholesterol, triglycerides, phospholipids and free fatty acids and decreased levels of ester cholesterol in plasma, kidney and liver found in cancer suffering animals were reverted back to near normal levels on treatment with KA and SA (Veena *et al.*, 2006). Triphala significantly decreased lipid peroxidation and the activity of lactate dehydrogenase (LDH) in 1,2-dimethylhydrazinedihydrochloride (DMH) induced Endoplasmic reticulum stress (ER stress) in mouse liver (Sharma and Sharma, 2011). In one another study, methanolic extract of the fruit at a dose of 200mg/kg BW possesses optimum chemopreventive effect against DMBA-induced buccal pouch carcinogenesis (Krishnaveni and Mirunalini, 2012). Growth inhibitory activity of *Emblica officinalis* was primarily manifested through induction of apoptotic cell death and through inhibition of AP-1 further accompanied by suppression of viral transcription resulted in growth inhibition of cervical cancer cells (Mahata *et al.*, 2013). The effect of the *Phyllanthus emblica* against cancer was also tried to enhanced by creating synthesize silver nanoparticles by amla extract, and it was observed that the AgNPs (silver nanoparticle) capped with biomolecules of amla enhanced cytotoxicity in laryngeal cancer cells through oxidative stress and apoptotic function on Hep2 cancer cells (Rosarin *et al.*, 2013).

Hepatoprotective Effect

Emblica officinalis fruits have been reported to be used for hepatoprotection in Ayurveda (Bhattacharya *et al.*, 2005). The protective effect and further inhibition of hepatic toxicity against ethanol induced rat hepatic injury was reported by some authors (Sultana *et al.*, 2005; Pramyothin *et al.*, 2006). The standardized herbal extracts showed reduction of lipid peroxidation and cellular damage against tert-butyl hydroperoxide (t-BH) induced toxicity (Hiraganahalli *et al.*, 2012). The fruit extract was reported as anti-hyperglycemic and hepato-renal in fluoride induced toxicity, it significantly reduced plasma glucose levels, SGOT, SGPT, ACP, ALP, hepatic G-6-Pase activity and increased hepatic glycogen content and hexokinase activity (Vasant and Narasimhacharya, 2012), fruit extract also found efficient in lessening intraperitoneally injected iron dextran-induced liver toxicity in Swiss albino mice (Sarkar *et al.*, 2013), protect liver against antituberculosis (anti-TB) drugs-induced hepatic injury due to its membrane stabilizing, antioxidative and CYP 2E1 inhibitory

roles (Tasduq *et al.*, 2005). The extract of *E. officinalis* and Chyavanaprash showed hepatoprotective effect in carbon tetrachloride (CCl₄) induced liver injury in rats. Both extracts were found to inhibit these elevated levels of serum and liver lipid peroxides (LPO), glutamate-pyruvate transaminase (GPT) and alkaline phosphatase (ALP) significantly, showing that the extract could reduce the induction of fibrosis in rat's model (Jose and Kuttan, 2000).

Cardioprotective, Cholesterol and Dyslipidemia

The *E. officinalis* showed cardioprotective effect against isoproterenol (ISP)-induced cardiotoxicity in rats, in this study the pretreatment with *E. officinalis* exhibited restoration of hemodynamic and left ventricular function along with significant preservation of antioxidants, myocytes-injury-specific marker enzymes and significant inhibition of lipid peroxidation the protection was attributed to its potent antioxidant and free radical scavenging activity which was evidenced by favorable improvement in hemodynamic, contractile function and tissue antioxidant status (Ojha *et al.*, 2012). The fresh fruit homogenate of showed adaptation on myocardial antioxidant system and oxidative stress induced by ischemic-reperfusion injury (IRI) against rats hearts by augmenting endogenous antioxidants and protects rat hearts from oxidative stress associated with IRI (Rajak *et al.*, 2004). Earlier, a human pilot study demonstrated a reduction of blood cholesterol levels in both normal and hypercholesterolemic men with treatment (Jacob *et al.*, 1988). It also decreased the low-density lipoprotein cholesterol and increased HDL cholesterol in ovariectomized rats fed chow or fructose. In ovariectomized and fructose-fed rats, it prevented insulin resistance aside from subduing the rise in triglycerides. Amla may be explored for its use in preventing dyslipidemia in postmenopausal women (Koshy *et al.*, 2012).

Antimicrobial and Antimutagenicity

Amla has also been reported for its antimicrobial activities (Srikumar *et al.*, 2007; Rani and Khullar, 2004). The ether extract and 80 percent alcoholic extract of fruits acidified with hydrochloric acid, were found to have antibacterial activity. The other extract of acidified alcoholic extract showed the highest activity, inhibiting the growth of *M. pyogenes* var. *S. typhosa* and *S. paratyphi* at a concentration of 0.21mg /ml and that of *M. pyogenes* var. *albus*; *S. schottmulleri* and *S. dysenteriae* at a concentration of 0.42mg/ml (Khorana *et al.*, 1959). The potent antibacterial activity was reported against *Escherichia coli*, *K. ozaenae*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *S. paratyphi A*, *S. paratyphi B* and *Serratia marcescens* (Saeed and Tariq, 2007). The chloroform and acetone extracts of Triphala showed inhibition of mutagenicity induced by both direct and S9-dependent mutagens (Kaur *et al.*, 2007). The fungal endophytes inhabiting *Embolica officinalis* showed antimicrobial and antioxidant activity (Nath *et al.*, 2012).

Osteoarthritis

Osteoarthritis (OA) is a serious, degenerative disease. *Embolica officinalis* fruits have been reported as chondroprotective agent in osteoarthritis therapy (Sumantran *et al.*, 2008). The ayurvedic formulations (extracts of *Tinospora cordifolia*, *Zingiber*

officinale, *Embolica officinalis*) were equivalent to glucosamine and celecoxib (Chopra *et al.*, 2013). There is preliminary evidence *in vitro* that its extracts induce apoptosis and modify gene expression in osteoclasts involved in rheumatoid arthritis and osteoporosis (Penolazzi *et al.*, 2008).

Respiratory Diseases

Amla is especially valuable in tuberculosis of the lungs asthma and bronchitis. Pulmonary antioxidant defenses are widely distributed in lungs and include both enzymatic and non enzymatic systems. The primary non enzymatic antioxidants are membrane bound vitamin C and Vitamin E. Amla is the richest source of flavonoids and vitamin C. As an antioxidant, it is very effective in inhibiting lipid peroxidation by scavenging reactive species and free radicals, thus preventing tissue damage. Dietary supplement with amla protects against *K. pneumoniae* mediated respiratory tract infection by keeping a check on the induction of proinflammatory cytokine like TNF- α (Saini *et al.*, 2008). It has also shown hypotensive effect and also a synergistic cholinergic and synergistic histaminergic effect on MABP, HR and RR of anaesthetized male dogs (Geer *et al.*, 2005). In Turkey, the fresh fruit is used for inflammations of the lungs. The juice or extract of the fruit is mixed with honey and pipit added is given to stop hiccough and also in painful respiration. The expressed juice of the fruit along with other ingredients is used to cure cough, hiccough, asthma and other diseases (Jayaweera, 1980).

Antidiabetic Effect

Due to its high vitamin C content, *E. officinalis* is effective in controlling diabetes. A tablespoon of its juice mixed with a cup of bitter gourd juice, taken daily for two months will stimulates the pancreas and enable is to secrete insulin, thus reducing the blood sugar in the diabetes. Diet restrictions should be strictly observed while taking this medicine. It will also prevent eye complication in diabetes (Sampat Kumar *et al.*, 2012). Diabetes mellitus increases the risk of cardiomyopathy and heart failure independent of underlying coronary artery disease. There may be a decrease in insulin sensitivity associated with autonomic dysfunction, hypertension and left ventricular (LV) hypertrophy. An increase in oxidative stress contributes to the characteristic morphological and functional abnormalities that are also associated with diabetic cardiomyopathy, the fruit juice was found beneficial for the treatment of myocardial damage associated with type 1 diabetes mellitus (Patel and Goyal, 2011). Another study was conducted where alloxan-induced diabetic rats were given an aqueous amla fruit extract. Decrease of the blood glucose, triglyceridemic levels and also an improvement of the liver function caused by a normalization of the liver-specific enzyme alanine transaminase activity was observed (Qureshi *et al.*, 2009). The hydro methanolic extract of *E. officinalis* leaves effectively normalized the impaired antioxidant status in streptozotocin induced diabetes in dose dependent manner than the glibenclamide-treated groups of rats. The extract exerted rapid protective effects against lipid peroxidation by scavenging of free radicals and reducing the risk of diabetic complications (Nain *et al.*, 2012). Aldose reductase (AR) has its involvement in development of secondary complications of diabetes including cataract. *E. officinalis* is proved as an important of AR. Exploring the therapeutic value of natural ingredients

that people can incorporate into everyday life may be an effective approach in the management of diabetic complications (Suryanarayana *et al.*, 2004). The anti-diabetic effect of *E. officinalis* was also reported by Kalekar and his co worker through an insulin sensitizing effect (stimulation of glucose uptake into adipocytes) (Kalekar *et al.*, 2013).

Indigestion, Anaemia, Jaundice and Dyspepsia

Clinical studies were conducted to investigate the effect of crude amla in gastritis syndrome. The crude amla was given in 20 cases in a dose of 3 gm, 3 times a day for 7 days. The drug was found effective in 85 per cent of the cases. It was observed that the drug did not have any significant beneficial effect in cases of hypochlorhydria. Only cases of hyperchloridia with burning sensation in abdominal and cardiac regions and epigastric pain were benefited (Singh and Sharma, 1971). The fresh juice of Amla is given as tonic, diuretic and anti-bilious remedy. It is also helpful in burning sensation, over thirst, dyspepsia and other complaints of digestive system. Use dried fruit with iron. Fermented liquor prepared from the root is used in jaundice, dyspepsia, cough, etc. Fruit possesses prokinetic and laxative activities in mice along with spasmodic effect in the isolated tissues of guinea pig and rabbit, mediated partially through activation of muscarinic receptors (Mehmood *et al.*, 2012). The therapeutic efficacy of amla in case of dyspepsia was evaluated with promising results in human subjects (Singh and Sharma, 1971; Chawla *et al.*, 1982).

Anti-Ulcer and Wound Healing

A herbomineral formulation of the Ayurveda medicine named Pepticare, composed of *Embllica officinalis*, *Glycyrrhiza glabra* and *Tinospora cordifolia* was tested for its anti-ulcer and anti-oxidant activity in rats. Reports were made that Pepticare exhibit anti-ulcer activity, which can be attributed to its anti-oxidant property (Bafna *et al.*, 2005). Methanolic extract of Eo was studied against ulcer and similarly represent significant ulcer protective and healing effects was observed this might be due to its effects both on offensive and defensive mucosal factor (Sairam *et al.*, 2002). The healing activity of gallic acid enriched ethanolic extract (GAE) of fruits (amlam) against the indomethacin-induced gastric ulceration in mice was investigated. The activity was correlated with the ability of GAE to alter the cyclooxygenase- (COX-) dependent healing pathways. Treatment with GAE (5mg/kg/day) and omeprazole (3mg/kg/day) for 3 days led to effective healing of the acute ulceration, while GAE could reverse the indomethacin-induced pro-inflammatory changes of the designated biochemical parameters. The ulcer healing activity of GAE was, however, compromised by coadministration of the nonspecific NOS inhibitor, N-nitro-L-arginine methyl ester (L-NAME), but not the i-NOS-specific inhibitor, L-N6-(1-iminoethyl) lysine hydrochloride (L-NIL). Thus the study suggested that the GAE treatment accelerates ulcer healing by inducing PGE (2) synthesis and augmenting e-NOS/i-NOS ratio (Chatterjee *et al.*, 2012). *E. officinalis* fruit extract promoted NO production, endothelial wound closure, endothelial sprouting, and VEGF mRNA expression. Therefore, it also proves useful in endothelial function and restoring wound healing competency (Chularojmontri *et al.*, 2013).

Other Diseases

Ophthacare is a herbal eye drop preparation containing basic principles of different herbs viz *Carum copticum*, *Terminalia belerica*, *Emblica officinalis*, *Curcuma longa*, *Ocimum sanctum*, *Cinnamomum camphora*, *Rosa damascena* and *Melospirum*. It exhibits a beneficial role in a number of inflammatory, infective and degenerative ophthalmic (Biswas *et al.*, 2001). Body weight loss in extract administered irradiated animals was significantly less in comparison with animals who were given radiation only (Singh *et al.*, 2005). Amla churna produced a dose-dependent improvement in memory of young and aged rats. It reversed the amnesia induced by scopolamine and diazepam. Amla churna may prove to be a useful remedy for the management of Alzheimer's disease due to its multifarious beneficial effects such as memory improvement and reversal of memory deficits (Vasudevan *et al.*, 2007; Ali *et al.*, 2013).

Conclusion

The use of medicinal plants in the management of various illnesses is due to their phytochemical constituents and dates back to historical age. While being exceptional for its ethnic, ethnobotanical and ethnopharmaceutical use, it is an important ingredient of many Ayurvedic medicines and tonics. Various extracts and herbal formulations of *Emblica officinalis* showed activities against various diseases and result is similar to standard drugs. It is one of the richest natural sources of Vitamin C and plays a vital role in preventing innumerable health disorders. It is considered to be a safe herbal medicine without any adverse effects. So it can be concluded that the Indian gooseberry is a traditionally and clinically proven fruit for both its application and efficacy.

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